

## **BOEM ENVIRONMENTAL STUDIES PROGRAM: Ongoing Studies**

**Region:** Alaska

**Planning Area(s):** Chukchi Sea

**Title:** Hanna Shoal Ecosystem Study (AK-11-03)

**BOEM Information Need(s) to be Addressed:** This study will constitute a key component of Chukchi Sea environmental studies pertinent to Chukchi Sea oil and gas activity. The highest oil industry interest is in the Burger prospect bordering Hanna Shoal to the south. The BOEM analysts and decision makers will use the information in NEPA analysis and documentation for Lease Sales, EPs and DPPs, and in post-sale and post-exploration decision making in the Chukchi Sea.

**Total Cost:** \$5,665,144

**Period of Performance:** FY 2011-2016

**Conducting Organization:** CESU-University of Texas at Austin

**BOEM Contact:** [Dr. Heather Crowley](#)

### **Description:**

Background: The ongoing COMIDA CAB study is highlighting the importance of Hanna Shoal in the NE Chukchi Sea as a biological oasis bordering the boundary between Chukchi and Arctic Ocean waters. The reason for this, however, is poorly understood. The shallower waters of the shoal have long been known as traps for grounding of bergy bits and deep-keeled sea ice, and a reoccurring polynya is created down current of the grounded ice.

Bering Sea water entering the Chukchi Sea and flowing north is thought to flow both to the east and west of the shoal. Historically, the transport of this warmer Bering Sea water past Hanna Shoal has resulted in melt out of open water “bays” in the ice cover on either side of Hanna Shoal. In most recent years with global warming, floating pack ice in summer persists in this area longer than elsewhere in the Chukchi, often surrounded by open water even to the north. This persistence strengthens the vertical stratification over Hanna Shoal as this residual summer ice melts and freshens the surface layer. Taylor columns may be responsible for maintaining ice in the regions of Herald and Hanna shoals. Circulation processes around Hanna Shoal are poorly understood, but the circulation here is part of a broader circulation field that connects the Chukchi and Beaufort. Waters draining through Herald Valley to the western Chukchi shelf and slope regions are carried to the eastern Chukchi, where outer shelf and slope waters are very likely brought back onto the shelf.

Biological “hot spots” in the Chukchi Sea are thought to be related to coupled pelagic and benthic productivity. A high abundance of bottom fauna is correlated with high pelagic primary production, possibly associated with the ice edge that reached the seabed mostly ungrazed. However, the mechanisms that must explain the productivity at Hanna Shoal are relatively poorly understood. With the retreat of the summer ice-

edge to deeper, more northern waters in recent years, this pelagic/benthic coupling may be weakening at Hanna Shoal. The ongoing productivity of this region depends on the timing and position of the ice edge. Other BOEM projects in the Chukchi are showing sustained benthic productivity in the area of Hanna Shoal accompanied by high concentrations of water birds, walrus, and whales. Ongoing BOEM studies looking at ocean heat transport across the central U.S. Chukchi Sea, to the south and at circulation to the east, toward Barrow Canyon will provide context to this study.

#### Objectives:

- Refocus the ecological monitoring started under COMIDA CAB to the region of Hanna Shoal, including nearby biological “hot spots.”
- Verify and enhance the food web/contaminant bioaccumulation structure developed in the COMIDA CAB study.
- Measure water column and benthic primary and secondary productivity and biomass, and determine the relation to oceanographic processes.
- Document annual circulation and density fields, as well as ice conditions, at Hanna Shoal throughout the year and examine important chemical, physical and biological interactions with the unique ecological regime in this highly productive area.
- Better understand the physical processes controlling circulation patterns in the region through analyses of numerical ocean process model results.
- Integrate effort and findings with recent and ongoing BOEM and other NE Chukchi Sea studies of higher trophic levels.
- Participate in the Distributed Biological Observatory for the Northeast Chukchi Sea

Methods: This project will continue COMIDA CAB benthic sampling, food web analysis, and contaminant measurements, focusing on the Hanna Shoal region. Water column primary and secondary production and biomass also will be measured. Cruise zooplankton data will be supplemented by data from moored zooplankton-sensing ADCP units capable of distinguishing copepod and euphausiid biomass signatures. Appropriate moored and shipboard measurements of currents, sea ice drift, and hydrography (including geochemistry) will examine circulation and density fields. Moorings will be used for long term profiling of temperature and salinity, including under ice measurements in winter. Additional oceanographic data may be obtained from other projects in the Chukchi, these data include: HF radar, moored acoustic Doppler current profilers (ADCP), meteorological buoys, gliders and moored zooplankton-sensing ADCP units capable of distinguishing copepod and euphausiid biomass signatures. Taxonomic information and vouchers for newly identified species will be provided to the National Museum at the Smithsonian Institution.

This study will use numerical ocean circulation model results for the Chukchi Sea to better understand the physical processes controlling circulation patterns in the region. Analyses will be performed on the model results to examine interactions of the flow field

and density structure with the topography and their relation to productivity and biomass distribution. Formal integration with other BOEM projects will be made through the “Marine Mammal/Physical Oceanography Synthesis.” Coordination will occur with other international, NSF, NOAA, ADEC, and industry research in the Chukchi Sea.

**Current Status:** Ongoing

**Final Report Due:** June 2016

**Publications Completed:**

- Fox, A., J. Trefry, R. Trocine, K. Dunton, S. Schonberg, N. McTigue, B. Konar, B. Lasorsa, C. Ashjian, L. Cooper. 2014. Patterns Of Mercury Biomagnification at Lower Trophic Levels in the Northeastern Chukchi Sea. Poster, Alaska Marine Science Symposium, Anchorage, AK, January 2014.
- Harvey, R. and K. Taylor. 2014. A Spatial Assessment Of Organic Contaminants And Hydrocarbons In Chukchi Sea Sediments: Results Of The COMIDA And Hanna Shoal Ecosystem Study Projects. Poster, Alaska Marine Science Symposium, Anchorage, AK, January 2014.
- Powell, K., B. Konar, A. Ravelo. 2014. Temporal Variation Of Epibenthic Communities In The Chukchi Sea, Alaska. Poster, Alaska Marine Science Symposium, Anchorage, AK, January 2014.
- Ravelo, A., B. Konar, B. Bluhm, K. Iken. 2014. Size Distribution And Abundance Of The Dominant Arctic Shelf Brittle Stars: *Ophiura Sarsii* And *Ophiocten Sericeum*. Poster, Alaska Marine Science Symposium, Anchorage, AK, January 2014.
- Weingartner, T., P. Winsor, S. Danielson, Y.-C. Fang, R. Potter, H. Statscewich and C. Irvine. 2014. The Hanna Shoal Circulation Field In The Northeastern Chukchi Sea. Oral presentation, Alaska Marine Science Symposium, Anchorage, AK, January 2014.

**Affiliated WWW Sites:** <http://www.boem.gov/akstudies/>  
<http://comidacab.org/>

**Revised Date:** December 2014

**ESPIS: Environmental Studies Program Information System**

**All *completed* ESP studies can be found**

**here:** [http://www.data.boem.gov/homepg/data\\_center/other/espis/espisfront.asp](http://www.data.boem.gov/homepg/data_center/other/espis/espisfront.asp)